

SEMESTER 3

FLUID MECHANICS

Course Code	PBAOT304	CIE Marks	60
Teaching Hours/Week (L: T:P: R)	3:0: 0: 1	ESE Marks	40
Credits	4	Exam Hours	2 Hrs .30 Min.
Prerequisites (if any)	NIL	Course Type	Theory

Course Objectives:

1. To understand the concepts of fluid mechanics.
2. To analyse the effects of pressure, velocity, and density of fluids on various bodies.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction: Fluids and continuum, Properties of fluids, Newton's law of viscosity. Ideal and real fluids, Newtonian and non-Newtonian fluids, Fluid Statics- Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, Centre of pressure, buoyancy, stability of immersed and floating bodies, measurement of pressure. (Problems)	10
2	Kinematics & Dynamics of fluid flow: Eulerian and Lagrangian approaches, Types of fluid flow. Equation of streamline, Velocity and acceleration in fluid flow, Euler's equation, Bernoulli's equation, Venturimeter and Orifice meters, Notches and Weirs (No derivations), Hydraulic Coefficients, Navier-Stokes equations. Dimensional analysis, Buckingham's theorem, non-dimensional numbers, Modal Analysis, Types of similarities (Problems)	11
3	Viscous flow & Head loss: Viscous flow through circular duct, parallel plates, Loss of head due to friction in viscous flow. Reynolds experiment, Frictional loss in pipe flow, Shear stress in turbulent flow a pipe, Velocity distribution in turbulent pipe flow, Major and Minor losses in pipe flow Hydraulic gradient and total energy line, Cavitation. (Problems)	12

4	Boundary Layer & Impact of jets: Growth of boundary layer over a flat plate and definition of boundary layer thickness, displacement thickness, momentum thickness and energy thickness, laminar and turbulent boundary layers, laminar sub layer, velocity profile, Von- Karman momentum integral equations for the boundary layers, calculation of drag, separation of boundary and methods of control. Impact of Jets-Force exerted by jet on moving plates.	11
----------	---	-----------

Suggestion on Project Topics

- Using flow visualisation techniques, study the fluid flow patterns.
- With the help of pneumatic/hydraulic cylinders (Eg: - syringe) study the Hydrostatic law
- Demonstrate the relationship between pressure, velocity, and elevation in a fluid, using simple models (Bernoulli's principle).
- Create a model to demonstrate different types of flow.

Course Assessment Method (CIE: 60 marks , ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment /Micro project	Internal Ex-1	Internal Ex-2	Total
5	30	12.5	12.5	60

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 1 Questions from each module. • Total of 4 Questions, each carrying 2 marks (4x2 =8marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. (8x4 = 32 marks)	40

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the basic principles of fluid mechanics, fluid properties and their relationships.	K2
CO2	Understand the basic concepts of Flow measuring devices and dimensional analysis.	K2
CO3	Apply the principles of kinematics and dynamics using conservation of mass and momentum to solve problems in pressure distribution, buoyancy, and stability.	K3
CO4	Analyse viscous flow through pipes and channels and estimate the major and minor losses.	K4
CO5	Create a physical model to analyse the effects of fluid flow parameters on various flow regimes.	K6

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2								2
CO2	3	3	2	3								2
CO3	3	3	2	2								2
CO4	3	3	3	3								2
CO5	3	3	3	3	2				2	2		2

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fluid Mechanics & Hydraulic Machines	R K Bansal	McGraw Hill	6th Edition
2	Fluid Mechanics, Fundamental and application	Yunus A. Cengal	McGraw Hill	7th edition
3	Fluid Mechanics	Pijush K. Kundu	McGraw Hill	2th edition

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fluid Mechanics	Frank M. White	McGraw Hill	8th edition
2	Hydraulic and Fluid Mechanics	Dr. Modi & S M Seth	Amit Publishers and distributors	

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	Fluid Statics - https://www.youtube.com/watch?v=rY7bvZn75Do&list=PLwdnzlV3ogoWrAmpEcsPXayfsXnFfY1O&index=4 Buoyancy, Metacentre, and stability - https://www.youtube.com/watch?v=gMuucNxc7eI&list=PLwdnzlV3ogoV-ATGY2ptuLS9mwLFOJoDw&index=7&pp=iAQB
2	Fluid kinematics - https://www.youtube.com/watch?v=rY7bvZn75Do&list=PLwdnzlV3ogoWrAmpEcsPXayfsXnFfY1O&index=4
3	Internal viscous flow - https://www.youtube.com/watch?v=qLx7ip0eBps&list=PLCoE5wxWtHFYiVGswvsWRaHjv18vxZzE2&index=17